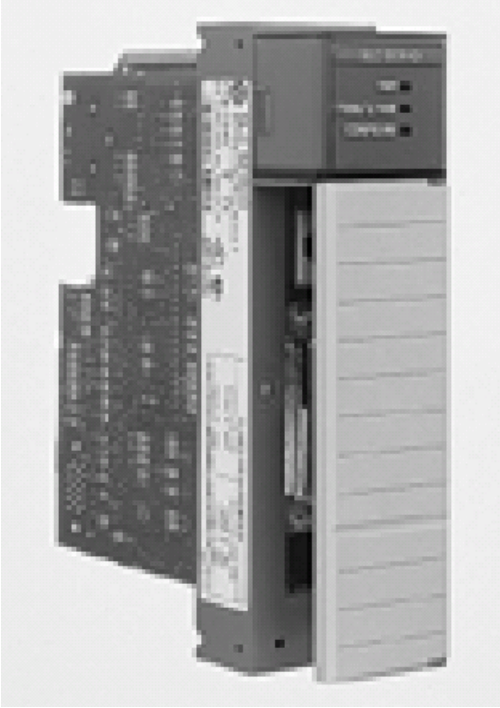
SLC Motion 1746 HSRV

Integration/Installation Guide

The SLC Servo Control Module is compatible with the SLC family. It is designed to be used with an SLC 5/03 FRN 5.0 and later processor. You can program and commission the system using
RSLogix 500, AI 500 or APS (5.0 or Later).

Once the SLC Processor is initiated, block execution is independent of the scan time of the processor. Blended motion allows for complicated move profiles consisting of two to 32 segments. The blended move profiles are stored in the SLC Servo Control Module's internal memory as a series of absolute moves. Since the sequence of moves is stored in internal memory, it can be executed more than once. Other move or homing operations can be performed between blended move profiles.



1746-HSRV
Motion Module

Each SLC Servo Control Module requires 12 input words and 12 output words. You don't need to do any off-line programming. The motion profile or sequence is determined in the RSLogix 500, AI 500, or APS (version 5.0 or higher) software that you use to program the SLC processor. You can command the following actions:

· Absolute moves
· Incremental moves
· Speed moves
· Monitor moves
· Hold moves
· Unhold moves
· Blend moves
· Emergency stop operations
· Homing operations
· Preset operations
· Clear faults
· Alternate home moves

You can configure and program up to 16 separate blend motion profiles to command from 2 to 32 segments of absolute move commands.
Three LED indicators are available, allowing you to quickly identify and troubleshoot faults.

More 1746-HSRV features include:

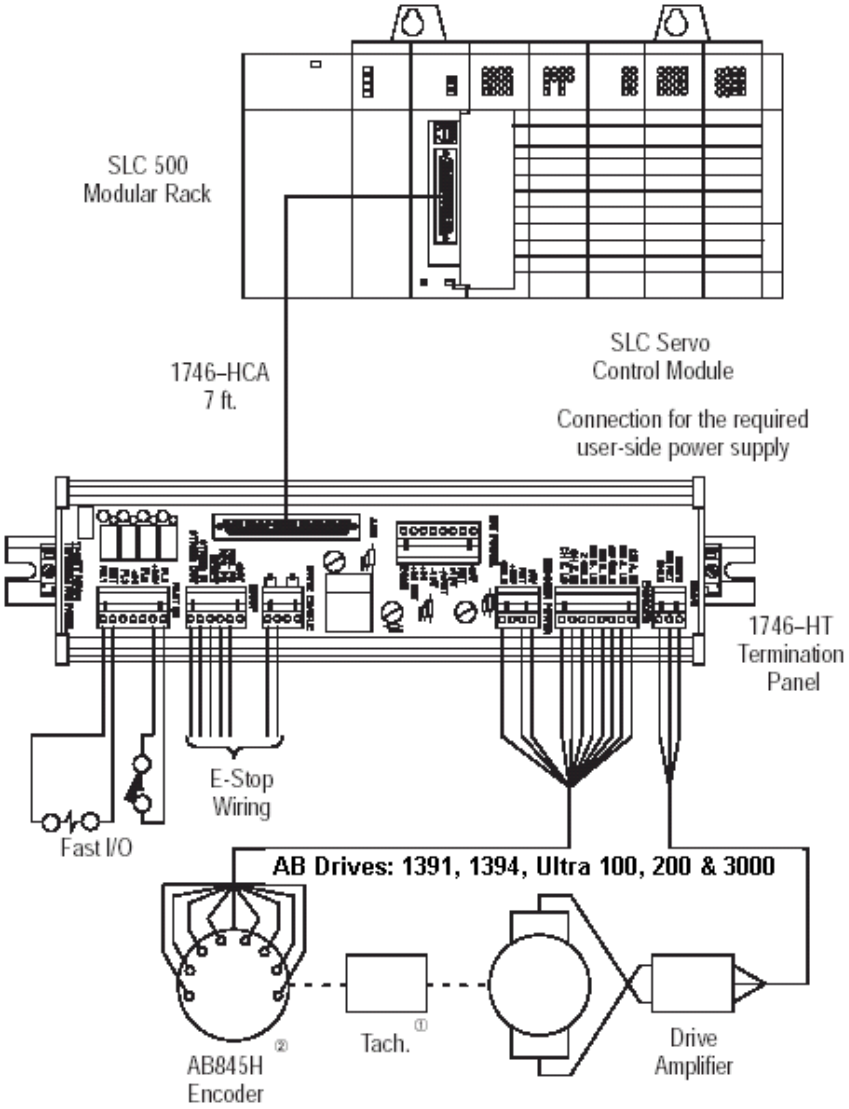
• Analog velocity command with programmable limits to interface with servo drives
• Three (3) fast inputs, and one (1) fast output
• 32 bit range for absolute positioning and blended motion profiles for complex moves
• Interfaces directly with +5 or +15V encoders

Typical SLC Servo Control System Configuration

Figure 1 shows a typical SLC Servo Control System configuration. This configuration includes:

- One SLC 500 modular rack (SLC 5/03 FRN 5 or later)
- One SLC Servo Control Module
- One 1746-HCA cable
- One termination panel
- Wiring for a servo system

Figure 1
Typical SLC Servo Control System Configuration



Ordering the SLC Servo Control System

Table B lists the catalog numbers you use to order the components of the SLC Servo Control System.

Table B
Ordering the SLC Servo Control System

Component	Catalog Number	What You Receive
Control module	1746-HSRV	Control module User Manual
Termination panel	1746-HT	Termination panel Mounting brackets Termination Panel Installation Data Sheet
Cable that connects the control module to the termination panel	1746–HCA	Cable
Documentation	1746-6.1.2	SLC Servo Control Module User Manual

Where to Find More Information

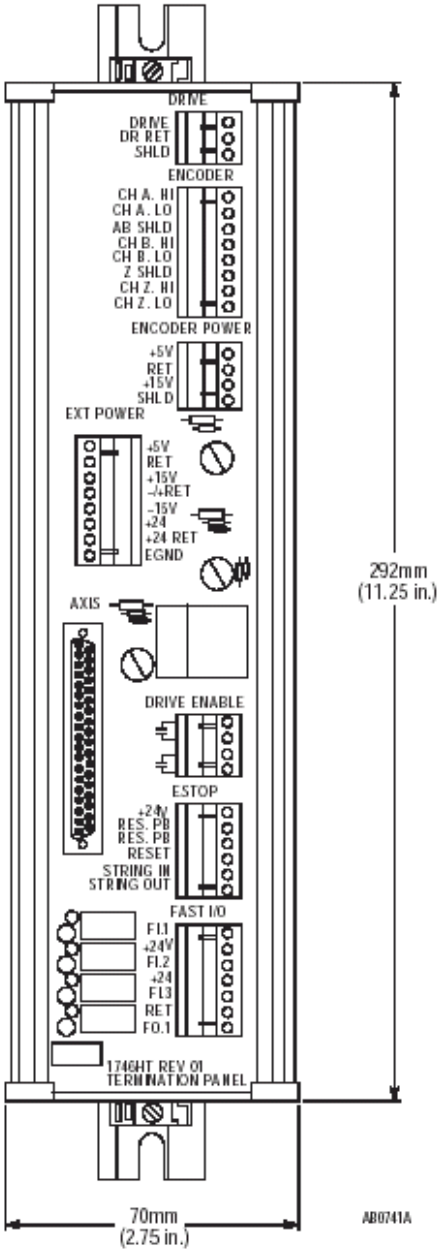
Refer to the SLC Servo Control Module User Manual for more information about the the following for the SLC Servo Control System:

- Selecting encoders, power supplies, and drives
- Installing the control module, termination panel, and handheld pendant
- Wiring fast I/O, E-stop, power supplies, encoders, and drives
- Integrating the axis
- Recovering from an error message

1746-HT Termination Panel

- Encoder which supports encoder feedback for one axis
- Drive connections to analog drive
- External power connections for +5V, 15V and +24V power from user power supply

Figure 3
1746-HT Termination Panel



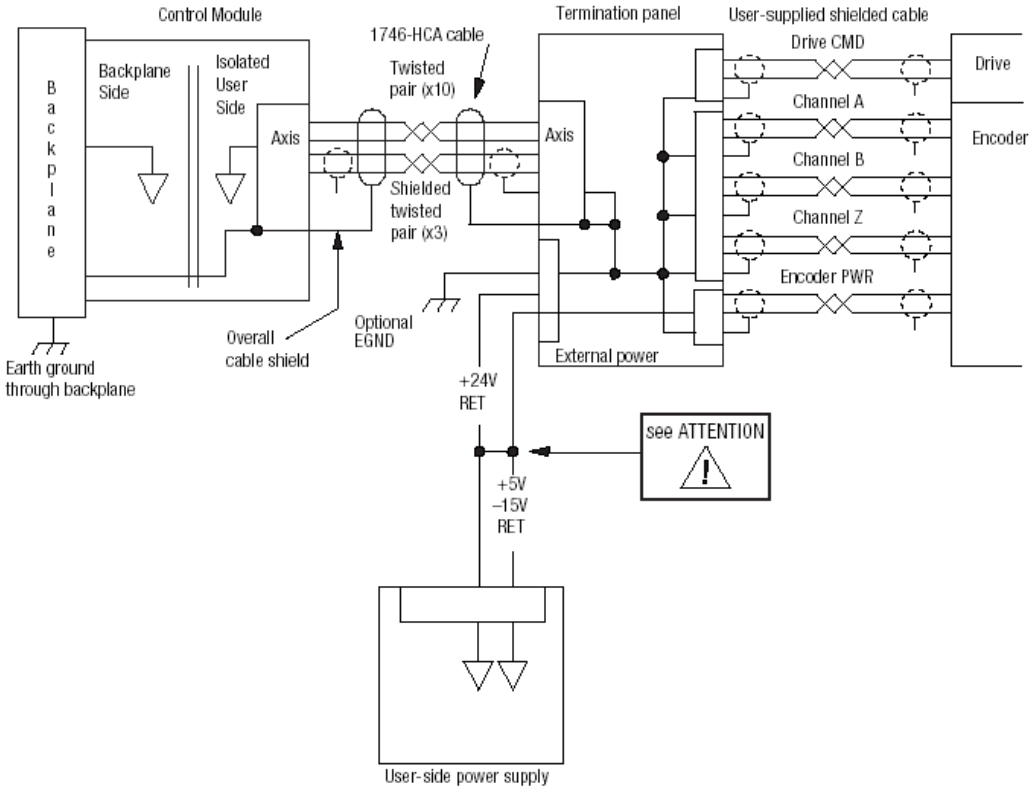
Important

Grounding the SLC Servo Module

Before you install the rest of the system, you must ground the SLC Servo Module. All of the shields and signal commons (normally floating) are tied to earth ground at a single point. Use the EGND terminal on the termination panel for this purpose.

IMPORTANT Do not connect shields to earth ground at both ends to avoid causing circuit loops that are susceptible to radiated and coupled noise.

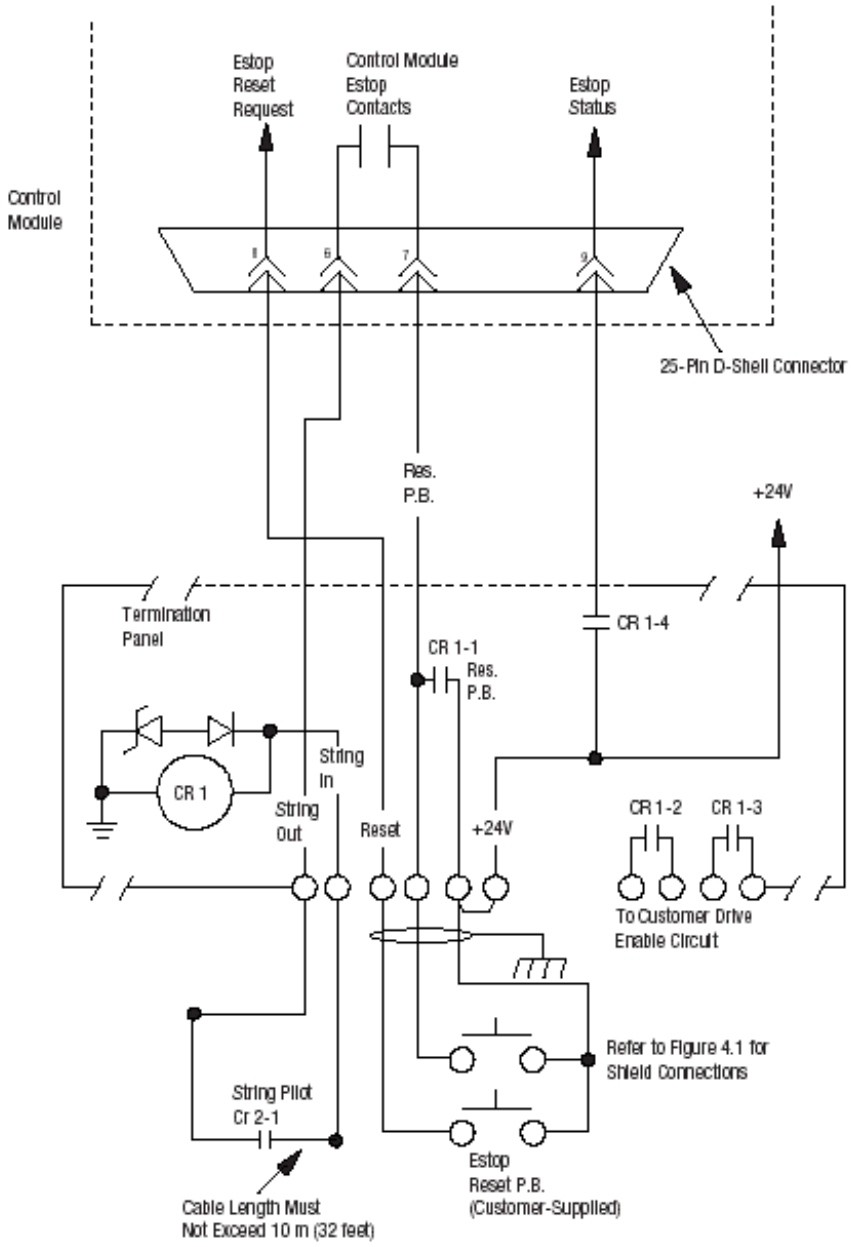
Figure 4.2 Typical Grounding and Shielding for the SLC Servo Module System



ATTENTION

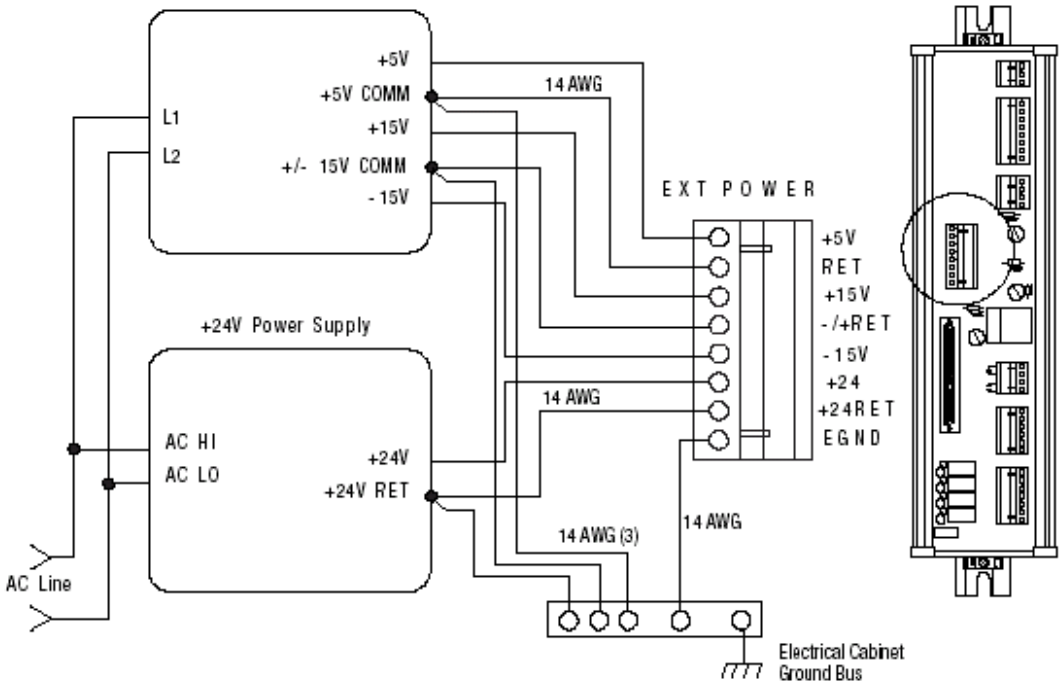
If you do not use the relay shown in Figure 5.8, verify that your replacement relay has a coil resistance greater than or equal to 650 ohms.

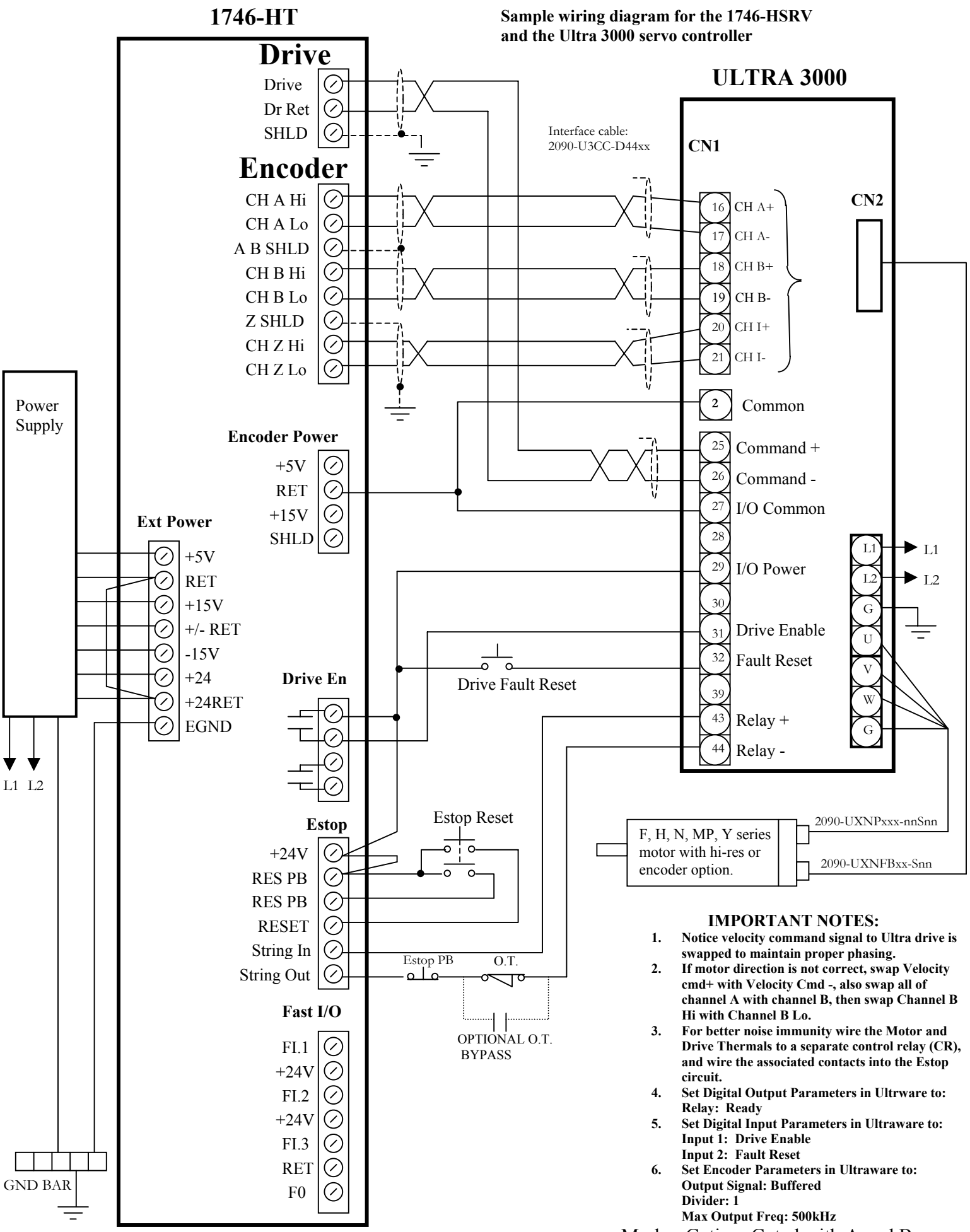
Figure 5.6 Estop Circuitry Diagram for a One-Axis System



When wiring the multiple power sources for the HSRV be sure to follow the following diagram for reference. Also reference the 1746-6.1.2 HSRV User Manual.

Figure 5.10 Wiring a +5V, ±15V, and a +24V Power Supply




1746-HT
Sample wiring diagram for the 1746-HSRV
and the Ultra 3000 servo controller
Drive
Drive
Dr Ret
SHLD
Encoder
CH A Hi
CH A Lo
A B SHLD
CH B Hi
CH B Lo
Z SHLD
CH Z Hi
CH Z Lo
ULTRA 3000
Interface cable:
2090-U3CC-D44xx
CN1
CN2
16 CH A+
17 CH A-
18 CH B+
19 CH B-
20 CH I+
21 CH I-
2 Common
25 Command +
26 Command -
27 I/O Common
28
29 I/O Power
30
31 Drive Enable
32 Fault Reset
39
43 Relay +
44 Relay -
L1
L2
G
U
V
W
G
Power
Supply
Encoder Power
+5V
RET
+15V
SHLD
Ext Power
+5V
RET
+15V
+/- RET
-15V
+24
+24RET
EGND
L1 L2
Drive En
Drive Fault Reset
Estop
+24V
RES PB
RES PB
RESET
String In
String Out
Estop Reset
Estop PB
O.T.
OPTIONAL O.T.
BYPASS
Fast I/O
FI.1
+24V
FI.2
+24V
FI.3
RET
F0
GND BAR
F, H, N, MP, Y series
motor with hi-res or
encoder option.
2090-UXNPxxx-nnSnn
2090-UXNFBxx-Snn
IMPORTANT NOTES:
1. Notice velocity command signal to Ultra drive is swapped to maintain proper phasing.
2. If motor direction is not correct, swap Velocity cmd+ with Velocity Cmd -, also swap all of channel A with channel B, then swap Channel B Hi with Channel B Lo.
3. For better noise immunity wire the Motor and Drive Thermals to a separate control relay (CR), and wire the associated contacts into the Estop circuit.
4. Set Digital Output Parameters in Ultrware to:
Relay: Ready
5. Set Digital Input Parameters in Ultraware to:
Input 1: Drive Enable
Input 2: Fault Reset
6. Set Encoder Parameters in Ultraware to:
Output Signal: Buffered
Divider: 1
Max Output Freq: 500kHz
Marker Gating: Gated with A and B
7-8-02

Setting Up Your SLC Servo Module

Before performing the procedures given in this chapter, follow the installation procedure supplied with the drive that will be interfaced to the SLC Servo Module. This chapter provides information to help you setup and configure the SLC processor and the SLC Servo Module and includes the following topics: (refer to publication 1746-6.1.2 for further information)

· Understanding the theory of motion control
· Powering up the SLC Servo Module
· Communicating between the SLC processor and the SLC Servo Module
· Entering encoder lines and computing counts
· Initializing DAC output voltage for drive symmetry
· Setting initial loop type
· Defining positive axis movement for the SLC Servo Module
· Coarse calibrating drive input scaling to SLC Servo Module DAC output voltage
· Fine calibrating of the DAC output voltage scaling
· Computing excess following error limit
· Selecting loop type
· Selecting axis acceleration rate
· Determining velocity and acceleration feedforward (for zero following error loop type only)
· Setting axis and home specific parameters
· Understanding programming conventions
· Configuring your SLC processor
· Understanding your SLC Servo Module interface
· Configuring your SLC Servo Module
· Before programming your SLC Servo Module
· Downloading your configuration
· Understanding configuration errors
· Configuring the M0 file data tables
· Configuring the M0 file floating-point data tables
· Understanding configuration parameters
· Homing options

Understanding the Theory of Motion Control

The major components of a motion control system are:
· Machine mechanics
· Velocity loop
· Position loop

Machine Mechanics

Machine mechanics are the combined gearing, ball-screws, and mechanical linkages that convert the motor's rotary motion into the axis motion that you want.

Velocity Loop

Velocity loop is a feedback control loop in which the controlled parameter is encoder velocity. A tachometer is usually used for the feedback device. Command input from the controller to the drive is a DC voltage that is proportional to encoder speed (e.g., 1V equals 5 rpm and 5V equals 5000 rpm). Using the tachometer as feedback, a drive maintains the speed of the encoder at the commanded speed within its output capabilities.
A typical drive contains adjustments to do the following:
· Scale the input command voltage to the motor speed.
· Zero the motor speed for a zero input command.
· Set the maximum current (torque) to the motor.
· Control the response of the velocity loop.
Refer to the drive manual for instructions on setting these adjustments.

Position Loop

Position loop is a feedback control loop in which the controlled parameter is mechanical position. The position loop compares position feedback with the position command to modify the velocity output signal to correct for any position error. Encoders are position measuring devices that provide the SLC Servo Module with precise actual axis position at all times. Based on motion statements, the SLC Servo Module computes an axis position and compares it to the actual axis position. Following error is the difference between the commanded axis position and the actual axis position. Axis gain (or position loop gain) sets the response on the position loop and scales the following error to the velocity command output (drive input).
Your SLC Servo Module is a single-axis motion control that resides in a 1746 (SLC) rack. With a drive and servo motor, an SLC Servo Module can control the position of one axis with encoder feedback. You can place multiple SLC Servo Modules in one SLC Rack to control an entire machine.

Powering Up the SLC Servo Module

The SLC Servo Module requires power from the SLC Rack backplane and the termination panel for proper operation. You must power-up the SLC Rack with the SLC Servo Module in the rack.
To power-up the SLC Servo Module:

1. Verify that your power supply connections for +5V DC, ±15V DC, and +24V DC are properly connected to the termination panel.

2. Verify that your cable between the termination panel and the SLC Servo Module is plugged in at both ends and the connectors are securely in place.

3. Apply power to the termination panel and SLC Rack power at the same time. The SLC Servo Module's green RUN LED is lit after a short delay for diagnostics.

4. If the SLC Servo Module's RUN LED is:
Then:
ON - Module is OK – continue configuration
OFF - Go to step 1. (The SLC processor indicates a slot fault at the SLC Servo Module location.)

Configuring the SLC Processor

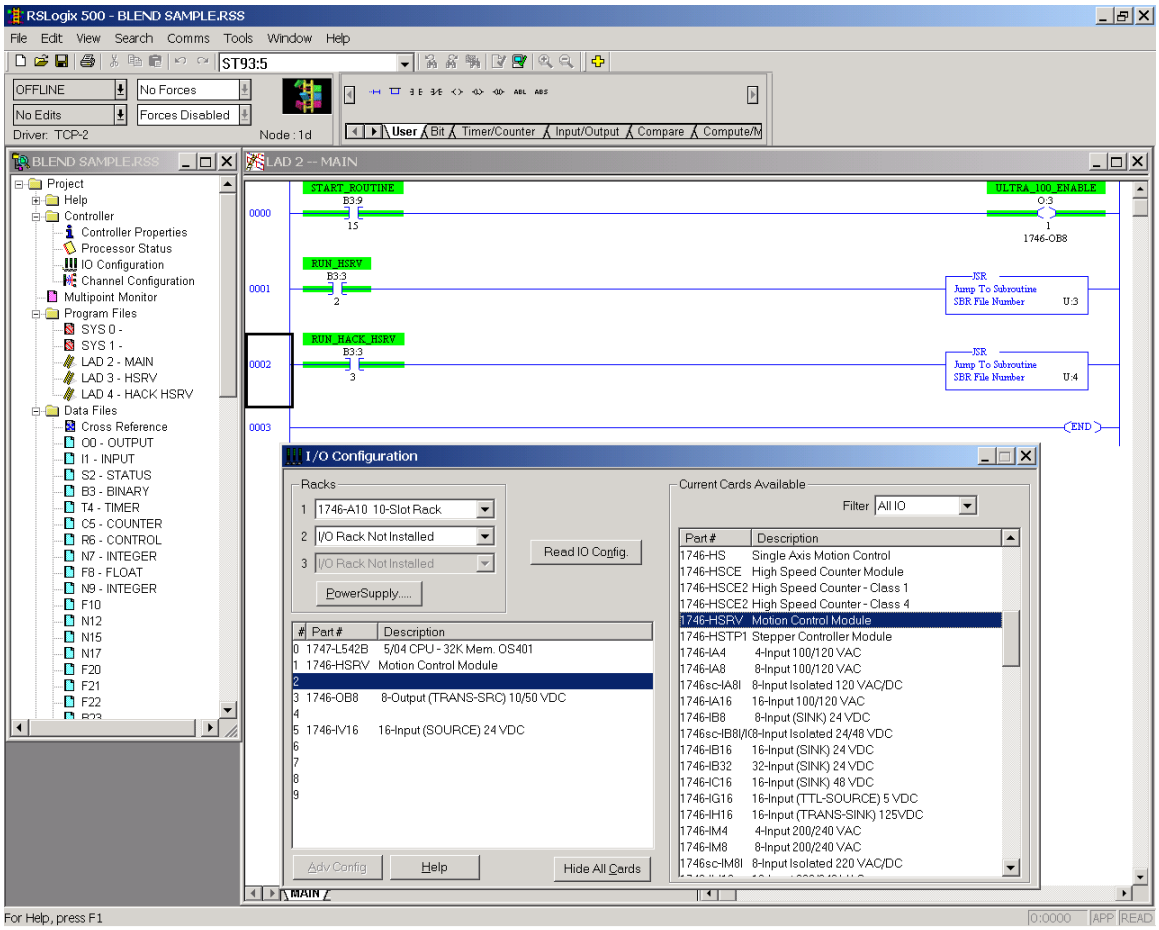
The SLC processor must be configured to accept the SLC Servo Module as an I/O device. Configure your processor by using the AI500, APS, or RSLogix 500 software running on a personal computer.

Using RSLOGIX 500 – start a new project. Select the correct processor based on application requirements.

Edit I/O configuration for rack (s) and necessary I/O per application requirement.

This is also when the 1746-HSRV motion module is selected and placed into the correct slot.

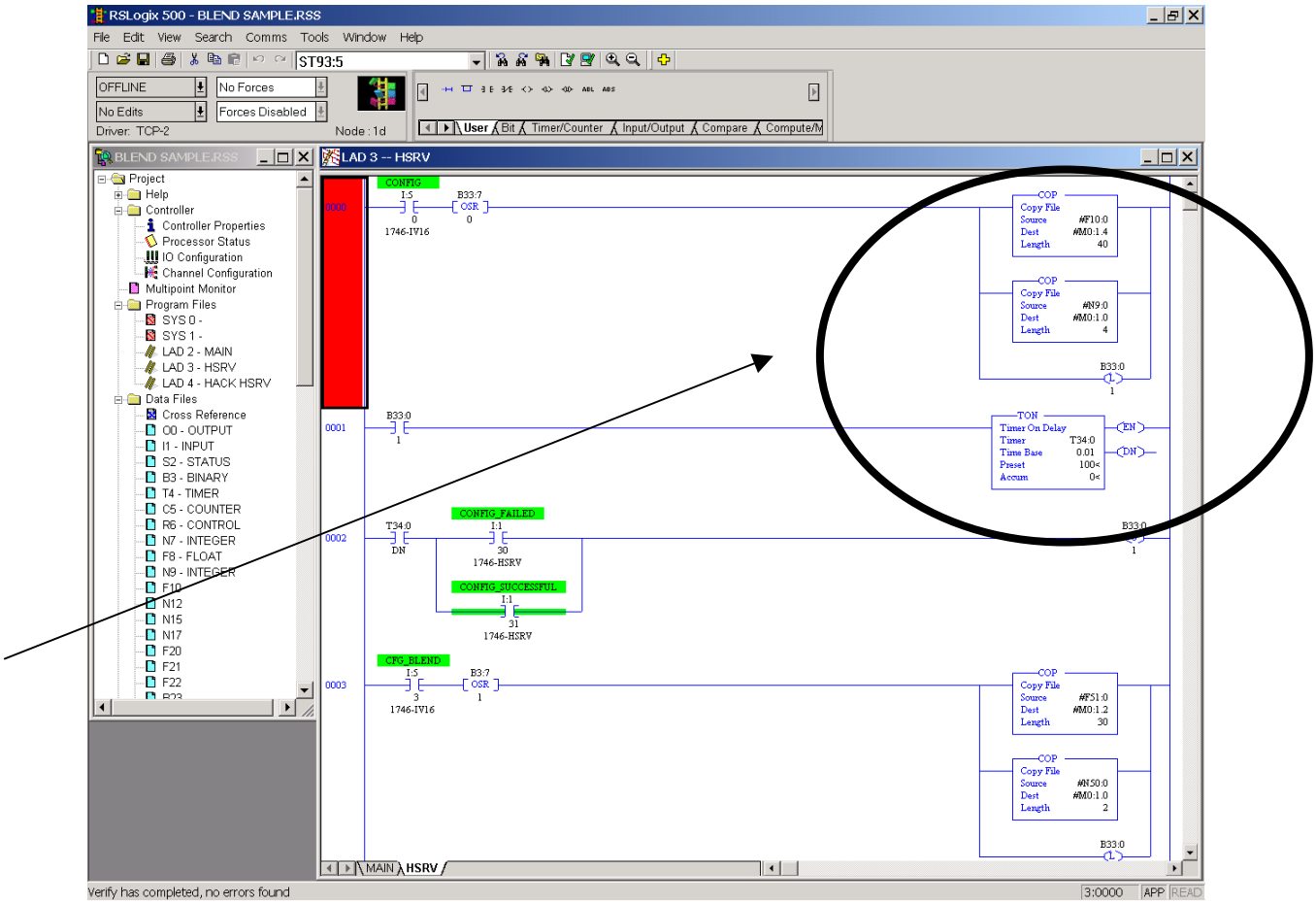
Program example from 1746-HSRV sample.



An alternate method will use the sample program from Allen-Bradley. This program contains many of the steps for setting up the module as found in chapter 7 of publication 1746-6.1.2 – July 2000.

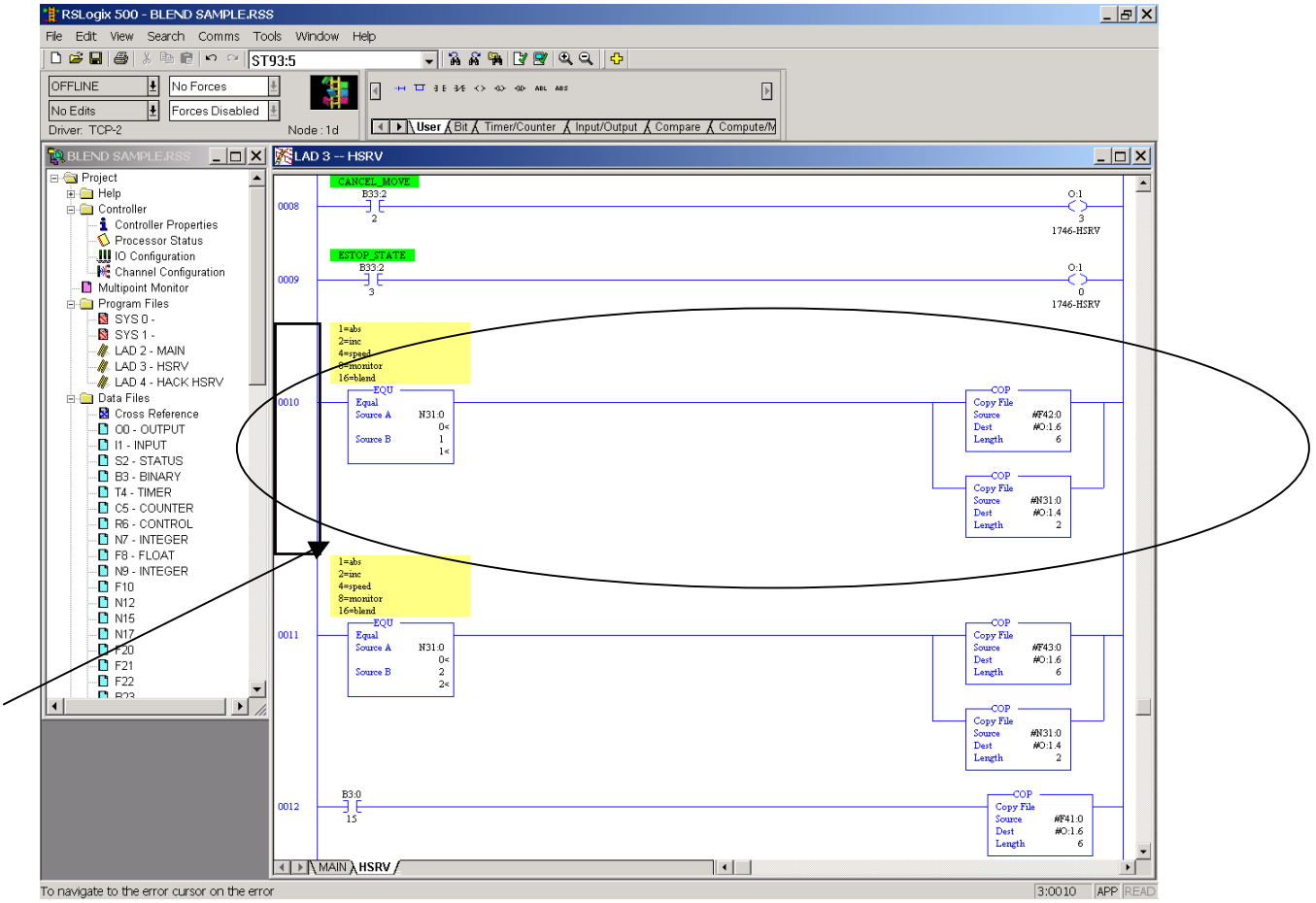
HSRV Sample.RSS, This program contains some basic starting/testing ladder logic for the HSRV module. Ladder files 3 & 5 contain this logic for the 1746-HSRV.

The file 3 is shown above. File 3 contains the ladder diagram for the configuration and control of the HSRV module.

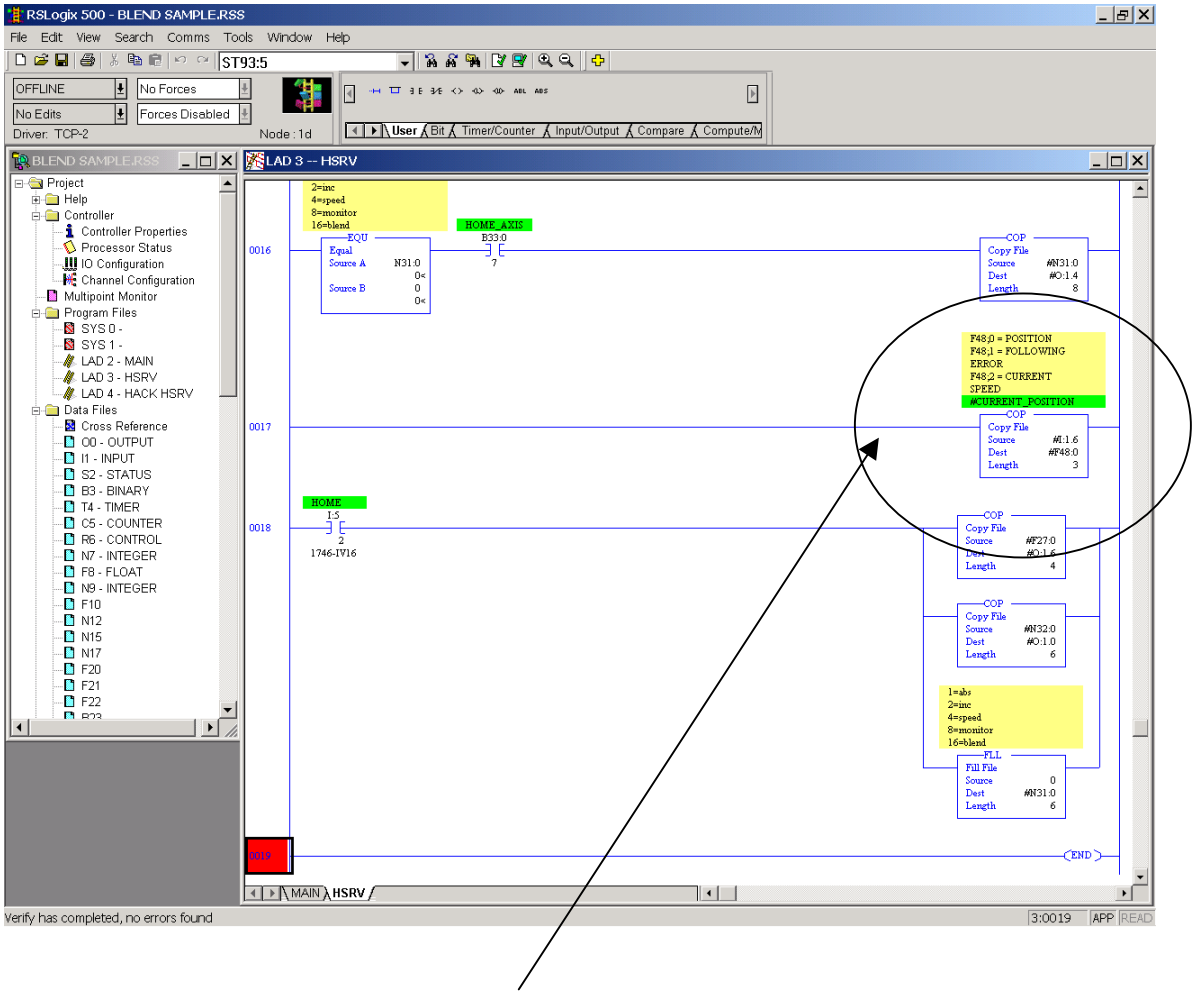


One key ladder file that is detailed for the HSRV module is ladder file 3. The above diagram points to this file and the configuration rungs. These rungs configure the HSRV. This is where all the setup parameters are loaded into the HSRV module. Note: This must be done on every power-up sequence. The 1746-HSRV does not have any memory retention on power cycles.

Reference chapter 7 of the Publication 1746-6.1.2 July 2000.



This example of ladder logic from the sample program shows discrete bits and also copy module for sending data to the HSRV module. This bits and data words for the HSRV may be found in the User Manual chapter 8. This is the Chapter on “Programming the SLC Processor to run the SLC servo module”.



Additional logic may be added for status and feedback such as position, velocity and following error status information. This data may be found in the appendix A. “Input/Output Quick Reference”.

Communicating Between the SLC Processor and the SLC Servo Module

Communication between the SLC processor and the SLC Servo Module occurs asynchronously through 12 input and 12 output words. The SLC Servo Module requires that an input is present from one to two coarse iterations before it is guaranteed to be recognized. SLC Servo Module ladder logic rungs contain timers that can provide the proper timing. The preferred method is to build handshake logic into the SLC Servo Module ladder program. A handshake occurs when the SLC processor requests a change and tests for an appropriate change in the SLC Servo Module status word before continuing.

The SLC Servo Module can deny requests from the SLC processor because the SLC Servo Module is not in the correct state to grant the request. Some SLC Servo Module inputs are only recognized on the input transition. If the SLC Servo Module is not in the correct state to grant a request when the input transition occurs, the input request is denied. Unless you toggle the input again, the SLC Servo Module ignores the request.

Before Programming the SLC Servo Module

Before programming your SLC Servo Module:

1. Power-up the SLC Servo Module to initialize the default configuration.

2. Verify that the SLC Servo Module is in an Estop state.

3. Copy the M0 file with the output word 0 mode bit (15) set to 1.

4. Verify that the SLC Servo Module is in the configuration mode.

5. Using the programming device for the SLC processor (RSLogix, AI500, or APS Software) enter the program example, found in Appendix C of this manual, with the appropriate changes for
the SLC Servo Module locations for the system.

6. Using the data monitor, change the values in the configuration files to match the default specifications for the SLC Servo Module, except for the Encoder Lines and Counts Per Position

Configuring the SLC Servo Module

You configure the SLC Servo Module using M files that reside on the SLC Servo Module. Refer to the *SLC 500 Reference Manual* (publication 1747-6.15), *M0 and M1 data file* section, for the M file interface and addressing convention information. M files reside on the module and are referenced by the ladder logic the same way as an integer file that resides on the module. There are two M files (M0 and M1) associated with this and any specialty module. The SLC Servo Module only uses the M0 file that is used to transfer the configuration information from the SLC Ladder to the SLC Servo Module. Refer to Figure 7.1 for a functional block diagram of the data flow.

The application program uses a copy file instruction to transfer the data from a source integer or float file to the M0 file in the slot that you want in the SLC Servo Module. A copy file instruction associated with the M files works as an immediate output instruction. Therefore, the normal ladder program execution stops when it encounters the copy instruction with the M file. Ladder program execution does not resume until the SLC processor has transferred the information to the M0 file of the SLC Servo Module.

NOTE: Repeatedly executing the copy file instruction when you download the configuration increases the ladder scan time.

Module Configuration

Unit parameters: For program example, the discrete configurations are in file N7 and the multiword floating-point parameters are in file F8.

Figure 7.2 Typical Ladder Program

In the ladder above, the floating-point file F8:0 and integer file N7:0 contain the configuration that you want for the SLC Servo Module in slot 1. They are copied once to the M0 file for slot 1 when requested. The configuration parameters are described later in this chapter. When an error is generated, the following events occur:

- CONFIG INV LED is lit.
- Errors are reported in word I:1.4 in decimal format.
- CONFIG INVALID Bit I:1.1/14 (I:1/30) is set.

Configuration Errors

The CONFIG INV LED on the SLC Servo Module turns on before or after power-up to indicate an invalid configuration.

The configuration error input bit (14) in configuration mode input status word 1 is set and input status word 4 of the module reports the errors detected if any one of the following occurs:

- There is no configuration file.
- The configuration is invalid.

Refer to the *Troubleshooting* chapter for a list of those configuration errors.

Configuring the M0 File Data Tables

The following tables contain configuration data for M0 word 0, word 1, and 2.

Word 0 Bit Parameters

Parameter Name	Source N File Location (note 1)	Destination M File Location (note 2)	Possible Values	Re-home	Default
DAC Enable	Nn:0/0	M0:s.0/0	Yes (1) / No (0)	No	Yes
Invert DAC	Nn:0/1	M0:s.0/1	Yes (1) / No (0)	No	No
Reverse Feedback	Nn:0/2	M0:s.0/2	Yes (1) / No (0)	No	No
Reserved	Nn:0/3	M0:s.0/3			0
Loop Type	Nn:0/5 Nn:0/4	M0:s.0/4 M0:s.0/5	Open (00) / FE (01) / VFF (10) / Reserved (11)	No	FE (01) 5=0, 4=1
Velocity Time Base	Nn:0/6	M0:s.0/6	Minutes (1) / Seconds (0)	No	Minutes
Overtravels Used	Nn:0/7	M0:s.0/7	Yes (1) / No (0)	No	No
Reserved	Nn:0/8	M0:s.0/8			0
Home Type	Nn:0/10 Nn:0/9	M0:s.0/10 M0:s.0/9	Homing Without a Limit Switch or Marker (00) / Homing to a marker (01) / Homing to a Limit Switch (10) / Homing to a Limit Switch and Marker (11)	Yes	Home to Marker 10=0, 9=1
Final Move to Which Marker?	Nn:0/11	M0:s.0/11	Marker Nearest Start Position (0) / 1 Rev, then Nearest Marker (1)	Yes	Marker Nearest Start Position
Final Move to Marker?	Nn:0/12	M0:s.0/12	Yes (1) / No (0)	Yes	Yes
Enable Incremental Position command	Nn:0/13	M0:s.0/13	Yes (1) / No (0)	No	0
Blend Move Profile	Nn:0/14	M0:s.0/14	Yes (1) / No (0)	No	No
Mode Flag	Nn:0/15	M0:s.0/15	Configure (1) / Command (0)	No	Command

1) Nn - Source N file number containing the module configuration data.

2) s - Slot number for the SLC Servo Module to be downloaded.

Word 1 Bit Parameters

Parameter Name	Source N File Location	Destination M File Location	Possible Values	Re-Home	Default
Limit Source	Nn:1/0	MO:s.1/0	Team Panel (1)/Backplane (0)	Yes	Backplane
Synchronized Move Source	Nn:1/1	MO:s.1/1	Team Panel (1)/Backplane (0)	No	Backplane
Reserved	Nn:1/2 through Nm:1/5	MO:s.1/2 through ML:s.1/5			0
Discrete Bit Status Word 1 Definition	Nn:1/6, Nn:1/7	MO:s.1/6,MO:s.1/7	Series, Major Rev, Minor Rev (00)/ Blend Move Profile Segment (10) / *Reserved* (01)/ *Reserved* (11)	No	Series, Major Rev, Minor Rev, 7=0m, 6=0
Inhibit Informational Codes	Nn:1/8	MO:s.1/8	Yes (1)/No (0)	No	No
Inhibit Minor Fault Codes	Nn:1/9	MO:s.1/9	Yes (1)/No (0)	No	No
Inhibit Major Fault Codes	Nn:1/10	MO:s.1/10	Yes (1)/No (0)	No	No
Reserved	Nn:1/11	MO:s.1/11			0
Inhibit Actual Position	Nn:1/12	MO:s.1/12	Yes (1)/No (0)	No	No
Inhibit Following Error	Nn:1/13	MO:s.1/13	Yes (1)/No (0)	No	No
Inhibit Current Speed	Nn:1/14	MO:s.1/14	Yes (1)/No (0)	No	No
Reserved	Nn:1/15	MO:s.1/15			0

Word 2 Bit Parameters

Parameter Name	Source N File Location	Destination M File Location	Possible Values	Re-Home	Default
Fits per CIT	Nn:2/0 through Nn:2/3	MO:s.2/0 through MO:s.2/3	0011-3 Fits per CIT, coarse time=4.8 msec 0100-4Fits per CIT, coarse time =6.4 msec 0101 - 5 Fits per CIT, coarse time = 8.0 msec 0100 - 6 Fits per CIT, coarse time = 9.6 msec	Yes	0011
Reserved	Nn:2/4 through Nn:2/15	MO:s.2/4 through MO:s.2/15			0
Reserved	Nn:3	MO:s.3			0

Configuring the M0 File floating-Point Data Table

The table below contains configuration data for the M0 file floating-point data table (M0 word 4 to word 43).

Word 4 or Multi-Word Parameters

Parameter Name	Source N File Location	Destination M File Location	Possible Values	Re-Home	Default
Encoder Lines (Lines/Rev)	Fn:0	MO:s.4,s.5	1 to 8000	Yes	1000.0
Counts per Position Unit	Fn:1	MO:s.6,s.7	1.0 to 16909320.0	Yes	4000.0
Positive Overtravel Limit (Position Units)	Fn:2	MO:s.8,s.9	Negative Overtravel Limit to +axis travel limit	No	100.0
Negative Overtravel Limit (Position Units)	Fn:3	MO:s.10,s.11	-axis travel limit to Positive Overtravel limit	No	-100.0
Rollover Position	Fn:4	MO:s,12,s.13	0.0 to axis travel limit	No	0.0
Home Position (Position Units)	Fn:5	MO:s.14,s.15	Negative Overtravel Limit to Positive Overtravel Limit	Yes	0.0
Home Calibration (Position Units)	Fn:6	MO:s.16,s.17	-axis travel limit to +axis travel limit	Yes	0.0
Speed/Direction of Move Off the Limit Switch (Position Units/Time)	Fn:7	MO:s.18,s.19	-physical lilmit to +physical limit	Yes	20.0
Speed/Direction of Move to the Marker (Position Units/Time)	Fn:8	MO:s.20,s.21	-physical limit to + physical limit	Yes	20.0
Reversal Error Value (Position Units)	Fn:9	MO:s.22,s.23	0.0 to axis travel limit	Yes	0.0
Output Voltage at + Max Speed (Volts)	Fn:10	MO:s.24,s.25	0.0 to 10.0	No	10.0
Output Voltage at - Max Speed (Volts)	Fn:11	MO:s.26,s.27	-10.0 to 0.0	No	-10.0
Maximum Axis Speed (Position Units/Time)	Fn:12	MO:s.28,s.29	0.0 to + physical limit	No	3000.0
Time to Maximum Axis Speed (Seconds)	Fn:13	MO:s.30,s.31	0.0 to + physical limit	No	1.0
Velocity Feedforward Constant	Fn:14	MO:s.32,s.33	0.0 to 1.0	No	0.0
Acceleration Feedforward Constant	Fn:15	MO:s.34,s.35	0.0 to 1.0	No	0.0
Home Tolerance (Position Units)	Fn:16	MO:s.36,s.37	0.0 to axis travel limit	No	0.1
Excess FE Limit (Position Units)	Fn:17	MO:s.38,s.39	0.0 to axis travel limit	No	3.0
In-position Band (Position Units)	Fn:18	MO:s.40,s.41	0.0 to axis travel limit	No	0.1
Axis Gain (Position Units per Minute per One Thousandth of the Position (Unit)	Fn:19	MO:s.42,s.43	0.0 to 10.0	No	1.0

Programming Conventions

The SLC Servo Module accepts and generates different types of data:

· Binary data that is compatible with the binary or integer files for the SLC processor.
· Integer data that is compatible with the SLC processor integer files.
· Floating-point data that is compatible with the SLC processor floating-point files. As the module interfaces to floating-point files, it is only compatible with the SLC 5/03 FRN 5.0 and above processors. Refer to the *SLC 500 Reference Manual* (publication 1747-6.15*)* for the floating-point file information.

Downloading Your Configuration

When you download your configuration using the M0 file for the module that you want, the types of data that are included are:

· Discrete parameters
· Floating-point parameters

You can download to the module using two copy file instructions to the M0 file of the SLC Servo Module:

· The first copy file instruction copies discrete information.
· The second copy file instruction copies floating-point information.

Depending on the values specified in the configuration, the module accepts the data or generates configuration errors through module input status words that are described in the next section.

Discrete Block Commands from the SLC Processor

The discrete block commands are sent from the SLC processor to the SLC Servo Module using discrete I/O. It contains two words of bit information and a variable number of integer and/or floating-point values.

Words 0 and 1 contain the SLC processor to SLC Servo Module discrete bit commands. Words 2 and 3 contain the Incremental Position command. Words 4 through 11 contain command blocks that control motion and/or motion related activities.

The SLC Servo Module responds to the new block command every time it differs from the one previously received. If command word 4 or word 5 is not zero, the SLC Servo Module reads each subsequent word to verify a change. The Plan Synchronized Move bit can be set in conjunction with a move in the simple move command set. To issue a discrete block command, set only 1 bit in words 4 and 5. If the SLC Servo Module finds more than one bit set in words 4 and 5 (except as noted earlier), an error is reported to the SLC processor.

As each block command is executed, the SLC Servo Module informs the SLC processor in a closed-loop fashion, using the SLC Servo Module to SLC processor discrete status bits. The discrete commands are classified into Incremental Position commands and simple move commands that are discussed in this section and into Position Initialization commands and On-line.

Recovering from Estop

If the Estop string is opened during a move, the move aborts. You can initiate another move once the Estop Reset is issued and the module is out of Estop. This can be done by setting/changing either the command bit, %Acceleration, Speed, Endpoint, or profile number. If these bits were set while in Estop, they must transition after the Estop resets to start a new move. If command parameter preparation requires more than one program scan, set up the accompanying parameters before setting the command bit.

Simple Move Commands

All simple moves are mutually exclusive. The simple move commands are the bsolute/Incremental, Speed, Monitor, and Run Blend Move Profile commands.
The currently executing move is considered complete when a new move is commanded by the SLC processor. A new move occurs when a change happens to any one of the following:
· Command bit
· % Acceleration parameter
· Velocity Unit Per Timebase (speed) parameter
· Position (endpoint) parameter
· Blend Profile number

For example, if an Absolute Move command is executing and the module receives a Speed Move command, the Absolute Move command is considered finished and the currently executing move command is blended into the new Speed Move command. This means that the execution and blending of moves is totally under SLC Ladder Logic Control.

The units for simple moves are:
· The position for each move block is in programming units (for example, inches, millimeters).
· The speed for each move block is in programming units (for example, inches per minute, millimeters per second).
· The acceleration or deceleration specified is in the percentage (0.0-1.0) of the maximum acceleration specified.

Using Simple Move Commands

The simple move commands discussed in this section are:
· Absolute/Incremental command
· Speed command
· Monitor command
· Run Blend Move Profile command

Using the Absolute/Incremental Move Command

The absolute move command generates a move equal to the difference between the specified target position and the current position, causing a positive or negative move, depending on the current axis position. Absolute and incremental move parameters for word 4, bit 0/1 appear in the table below.

Block Command Parameters	Location1	Format	Possible Values	Default
Absolute Move OR Incremental Move	O:s.4	BITS	X000 0000 0000 0001 (absolute) X000 0000 0000 0010 (incremental)	0 0
More Bit Specifications	O:s.5	BITS	0000 0000 0000 0000	0
% Acceleration Ramp	O:s.6-O:s.7	FLOAT	0.0 to 1.0	1.0
Speed	O:s.8-O:s.9	FLOAT	0.0 to +physical limit	0.0
Position/Decrement	O:s.10-O:s.11	FLOAT	–axis travel limit to +axis travel limit	0.0

[1] s = Slot number for the SLC Servo Module.

The SLC Servo Module responds differently depending on which command has not completed (if any) when the Incremental Move is initiated, as shown in the table below.

If you initiate this command:	And initiate an incremental move before the first command is finished, the Servo Module:
Absolute Move	Adds the absolute and incremental moves together and stops when the moves are complete.
Incremental Move	Adds the incremental moves together and stops when the moves are complete.
Speed Move	Blends the speed move to the incremental move and stops when the incremental move is complete.
None (no command)	Moves the distance of the incremental move and stops when the move is complete.

If the SLC Servo Module is configured with the rollover position, the move commanded can cause multiple rollovers. The following information applies to the Absolute/Incremental move:

· The speed specified for the move is the absolute maximum for the move.
· If the speed specified is greater than the Maximum Axis Speed, the speed for the move is limited to the Maximum Axis Speed
· The axis has to be homed to perform an absolute move
· If an error occurs while executing the move, the SLC processor is notified.

The Absolute/Incremental move ends if any one of the following occurs:
· The move reaches its destination.
· The SLC processor cancels the move. The Cancel Move bit is used to cancel the absolute or incremental component of the move. Setting the Cancel Move bit does not affect an incremental position command component (i.e., the specified incremental position command continues unless it is set to zero).
· An Estop occurs.
· The SLC processor sends another move from the mutually exclusive move set including a move of the same type with different % Acceleration Ramp, Speed, or Position/Increment. A new absolute move can also be initiated by simply changing the acceleration, speed or position and keeping all other discrete bits the same.
Planning an Absolute/Incremental Move.
Below shows a typical ladder program block diagram that initiates an absolute/incremental move from the SLC processor. Other moves are initiated similarly by setting appropriate values in the data tables and copying the data to the appropriate module output words.

Absolute/Incremental Move Command Block Diagram

For example, an absolute move is initiated if the float data table is:

Word	0 (Accel/Decel)	1 (Velocity)	2 (Position)	3	4	5
F43:0	1	500	20			

And the integer data table is:

Word	0	1	2	3	4	4
N31:0	1	0	0	0	0	0

Word 1 Discrete Bit Status Specifications

Bit Specifications	Location[1]	Description
Axis Ready	I:s.1/0	Bit 0 signals that the motion control has powered up successfully. Other I/O bits are not valid unless this bit is set.
Estop State	I:s.1/1	This bit is set when the SLC Servo Module is in Estop. The bit is cleared when the operator or SLC Ladder Logic has performed an Estop reset.
Information Message	I:s.1/2	This bit, if uninhibited, is set when the SLC Servo Module has an informational message to be conveyed to the SLC processor. The bit is cleared using either the Clear Fault or Clear All Faults bit.
Minor Fault	I:s.1/3	This bit, if uninhibited, is set when a minor fault is detected by the SLC Servo Module. The bit is cleared using either the Clear Fault or Clear All Faults bit.
Major Fault	I:s.1/4	This bit, if uninhibited, is set when a major fault is detected by the SLC Servo Module. The bit is cleared using either the Clear Fault or Clear All Faults bit.
Fault FIFO Full	I:s.1/5	This bit is set when the 16 element fault FIFO resident in the SLC Servo Module is full of faults. This could occur when faults get reported, but not cleared. Faults can be cleared using either the Clear Fault or Clear All Faults bit.
Reserved	I:s.1/6 through I:s.1/7	
Axis Needs Homed	I:s.1/8	This bit is set until the axis is homed after power-up and any time a feedback fault is detected by the SLC Servo Module.
Homing	I:s.1/9	This bit is set when the axis is being homed.
Retract Position	I:s.1/10	This bit is set when a Retract Position operation is in progress.
At Home	I:s.1/11	This bit is set when the actual position is within the home tolerance of the home position. It is not set if the actual position crosses the home position during the homing sequence. This could happen if the axis has already been homed since power-up.
Overtravel –	I:s.1/12	This bit is set when the axis has attempted to move beyond the negative overtravel limit.
Overtravel +	I:s.1/13	This bit is set when the axis has attempted to move beyond the positive overtravel limit.
Configuration Failed	I:s.1/14	This bit is set when the blend move profile or axis configuration information just received by the SLC Servo Module using the M0 file transfer mechanism contained errors. This bit is cleared while the SLC Servo Module verifies whether the M file content demonstrates inter-parameter compatibility and if the configuration process was successful.
Configuration Successful	I:s.1/15	This bit is set when the blend move profile or axis configuration information just received by the SLC Servo Module using the M0 file transfer mechanism is free of errors. This bit is cleared while the SLC Servo Module verifies whether or not the M-file content demonstrates inter-parameter compatibility and if the configuration process failed. This bit is set after a successful power-up of the SLC Servo Module.

[1] s = Slot number for the SLC Servo Module

Word 2 Discrete Bit Status Specifications SLC Servo Module

Bit Specifications	Location[1]	Description
In-Position	I:s.2/0	This bit is set when the actual position for the axis is within the in-position band of the end position of the currently executing move. The in-position band must be greater than or equal to the system's standing following error but smaller than the magnitude of the position move. If the in-position band is not set to a large enough value, the in-position bit is not set for the move. If the in-position band is set to a value that is too large, the in-position bit could turn on sooner than you want.
Move Complete	I:s.2/1	The move complete bit is set when an interpolated move is no longer being interpolated. The IMC Classic product line called this the NOSETTLE point.
Axis Stopped	I:s.2/2	A 1 in this bit indicates the axis is at rest.
Axis Held	I:s.2/3	This bit is set when the axis is being held by the Hold Move bit.
Accelerating	I:s.2/4	This bit is set when an interpolated move is accelerating.
Decelerating	I:s.2/5	This bit is set when an interpolated move is decelerating.
Reserved	I:s.2/6 through I:s.2/7	
FIN[1] State	I:s.2/8	These bits reflect the current state of the corresponding fast input (FIN [1]).
FIN[2] State	I:s.2/9	These bits reflect the current state of the corresponding fast input (FIN [2]).
FIN[3] State	I:s.2/10	These bits reflect the current state of the corresponding fast input (FIN [3]).
FOUT State	I:s.2/11	This bit reflects the current state of the fast output (FOUT).
Reserved	I:s.2/12 through I:s.2/15	

[1] s = Slot number for the SLC Servo Module

Word 3 Discrete Bit Status Specifications

Bit Specifications	Location[1]	Description
Absolute Move In Progress	I:s.3/0	Absolute move is in progress.
Incremental Move In Progress	I:s.3/1	Incremental move is in progress.
Speed Move In Progress	I:s.3/2	Speed move is in progress.
Monitor Move In Progress	I:s.3/3	Monitor move is in progress.
Blend Move In Progress	I:s.3/4	This bit is set when the corresponding move is in progress.
Reserved	I:s.3/5 through I:s.3/12	
Blend Move Profile Configuration In Progress	I:s.3/13	This bit is set while the SLC Servo Module verifies whether the blend move profile specification, provided by the M-file that was just received, is achievable. Configuration Failed and Configuration Successful are both cleared while this bit is set.
Servo Configuration In Progress	I:s.3/14	This bit is set while the SLC Servo Module verifies whether the SLC Servo Module configuration, provided by the M-file that was just received, contains parameters that are compatible with one another. Configuration Failed and Configuration Successful are both cleared while this bit is set.
Synchronized Move Ready	I:s.3/15	This bit is set when a synchronized move is planned and ready for execution.

[1] s = Slot number for the SLC Servo Module

SLC Servo Module Processor Status

Informational messages and fault codes detected and reported by the SLC Servo Module are described in this section.

Informational Message or Fault Code

If Informational Message or Fault Code is inhibited, no values are reported and I:s.4 returns a 0. The table below contains typical input data for words 4-11. For additional information on decimal values, refer to the *Troubleshooting* chapter.

Status Block Parameters	Location[1]	Format	Possible Values	Default	Description
Informational Message Or Fault Code	I:s.4	USHORT	0 to 65,535	0	
Reserved	I:s.5	STDSHORT	–32,767 to +32,767	0	
Actual Position	I:s.6-I:s.7	Float	–axis travel limit to +axis travel limit	0.0	The current actual position of the axis; if inhibited, returns 0.
Following Error	I:s.8-I:s.9	Float	–axis travel limit to +axis travel limit	0.0	The current following error of the axis; if inhibited, returns 0.
Current Speed	I:s.10-I:s.11	Float	-physical limit to +physical limit	0.0	The current speed of the axis; if inhibited, returns 0.

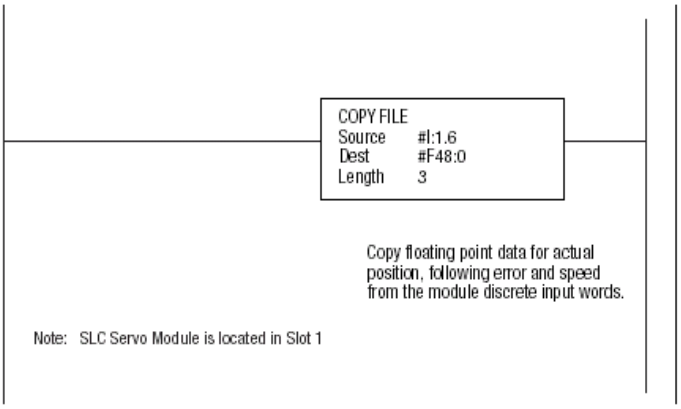
[1] s = Slot number for the SLC Servo Module

Floating-Point Values

Three floating-point value data items are shown below. We recommend that you incorporate the following rung in the ladder program to convert the integer data from the module to floating-point data for comparison or display purposes.

Figure 9.3 Copy Command for Integer Data to Floating-Point Data Conversion

This program "rung" is very useful to see the "position, following error & speed" from the motion axis.


COPY FILE
Source #I:1.6
Dest #F48:0
Length 3
Copy floating point data for actual position, following error and speed from the module discrete input words.
Note: SLC Servo Module is located in Slot 1

Troubleshooting..

Troubleshooting LED Indicators

The RUN, FDBK/U. PWR, and CONFIG INV LED indicators on the SLC Servo Module serve as diagnostic tools for troubleshooting. Refer to the table below for general conditions.

General Condition	Potential Cause	Possible Resolution
The RUN LED is not green.	Indicates a major SLC Servo Module malfunction or lack of power from the backplane or the user supplies.	1. Check that power is present from the backplane. 2. If power is present, replace the SLC Servo Module.
The FDBK/U PWR LED is red.	No user power.	Check user power supply and connections to termination panel.
The CONFIG INV LED is red.	Using default values or invalid data	• Check fault word code. • Change parameter. • Reconfigure parameters.

The following table shows the status indicators for the LEDs and what action might need to be taken.

When the LED status indicators are:		Your system status is:	And the action to take is:
RUN FDBK/U.PWR CONFIG INV	On Off Off	System O.K.	Continue
RUN FDBK/U.PWR CONFIG INV	Off Off Off	Power is not applied or there is a catastrophic failure.	Apply power
RUN FDBK/U.PWR CONFIG INV	Off Off On	Hardware failure	1. Troubleshoot 2. Repair the hardware that failed
RUN FDBK/U.PWR CONFIG INV	Off On Off	Hardware failure	1. Troubleshoot 2. Repair the hardware that failed
RUN FDBK/U.PWR CONFIG INV	Off On On	Power-up or RAM failure	1. Verify power supply connections for +24, ±15, +5, and encoder feedback signals 2. Troubleshoot 3. Repair power-up problem or contact Allen-Bradley for RAM failure
RUN FDBK/U.PWR CONFIG INV	On Off On	Configuration not loaded	1. Check your program configuration 2. Repair your program configuration
RUN FDBK/U.PWR CONFIG INV	On On Off	Feedback fault (broken wire, quadrature fault) or loss of user power	1. Troubleshoot 2. Repair the feedback wire or the reason for the loss of user power
RUN FDBK/U.PWR CONFIG INV	On On On	Configuration not loaded and loss of user power	1. Check your program configuration 2. Repair your program configuration 3. Repair the reason for loss of user power

Error Messages and Diagnosis

The user manual provides a numerical listing of informational messages, minor fault messages, and major fault messages accompanied by potential causes and possible resolutions.

Additional information may be found at: http://support.rockwellautomation.com/
this is the “support” web site. Search for “HSRV” under the **Knowledgebase** selection.
A sample program and also troubleshooting tips may be found here.

The user manual may be downloaded from: http://www.ab.com/manuals/gmc/
use SLC Products for further searching.